

REMARKS

The Examiner is thanked for the careful examination of this application. Claims 11, 12 and 14-21 are currently pending.

Amendments to the Specification

Applicant has previously argued that the claims encompassed and embodiment illustrated in Fig. 3, and that the claimed invention involved recycling of the alkyl ester (and potentially other materials). Upon a review of the Specification, Applicant noted a number of instances where the Specification allowed for ambiguity – namely, refluxing, rather than recycling of the alkyl ester. Accordingly, Applicant has submitted amendments to the Specification to clarify this within the Specification and conform the Specification to what one having ordinary skill would understand from the Drawings. Thus, Applicant requests entry of the amendments to paragraphs 0015, 0019, 0030, 0056, 0075, 0076, 0079, 0093 and 0137, and to the Abstract, as submitted. Applicant notes that the paragraph numbers used herein are from the published application, and in some cases differ from those of the specification as filed – particularly that paragraph [102] of the filed application is paragraph 0093 of the published application.

Rejections under 35 U.S.C. § 112

The Office Action rejected claim 14 under 35 U.S.C. § 112, second paragraph, as indefinite. Applicant respectfully traverses. However, solely for the purpose of expediting the prosecution of this application, claim 14 has been amended to address the comments of the Office Action. Applicant respectfully requests that the rejection of claim 14 under 35 U.S.C. § 112 be withdrawn.

Rejections under 35 U.S.C. § 103

Claims 11, 12 and 14-21 were rejected under 35 U.S.C. 103(a) as being unpatentable over Lever Brothers & Unilever Limited (GB 612,667), hereafter “Lever”, in view of Sucher & Holzer Bauplan Handel (AT 406870B), hereafter “Sucher”, in view of Peter et al. (WO03/004591; US 6,933,398), hereafter “Peter”, and further in view of Peterson et al. (JAOCS, Vol. 61,1984), hereafter “Peterson.” Applicant respectfully traverses for at least the reasons set forth below.

Amendment to Claim 11

Applicant has amended claim 11 to clarify the language of claim 11. Applicant has amended claim 11 to make clear that the alkyl ester is recycled in the process, rather than refluxed, as allegedly is shown in the prior art. Applicant submit that this clarification would have been obvious based on a review of the specification and drawings of the application, but makes the amendment for the purpose of eliminating any potential ambiguity.

Comparison of Refluxing and Recycling Methods

In the cited art, as exemplified by Sucher, Sucher describes a method for preparation of fatty acid alkyl ester by partially recycling the fatty acid alkyl ester generated from reaction between the triglyceride and the alcohol in the presence of a catalyst (see Abstract of Sucher). However, Sucher adopts recycling of the crude alkyl ester after separation of a crude alkyl ester phase and a glycerin phase, which is distinct from the claimed invention.

In contrast, with Applicant’s process, the claimed invention includes recycling the alkyl ester, which was esterified in the reactor (14), into the reactor (11) or the mixer (13) prior to going through the glycerin/ester separator (15). See, for example, Applicant’s Fig. 3, reproduced below:

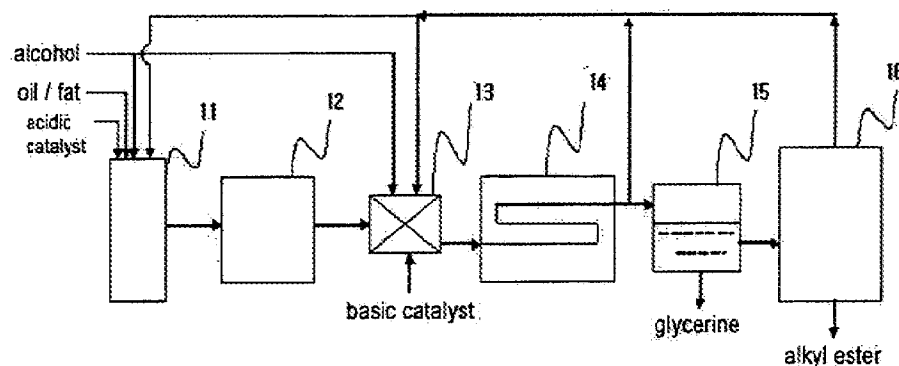


Fig. 3

Therefore, in contrast to Sucher, Applicant's process recycles alkyl ester and glycerine along with non-reacted tri-, di-, mono-glyceride, rather than using the refined and separated alkyl ester. This is a significant departure from the process of Sucher, allowing for a simpler and more efficient process.

As described in Sucher, purification and recycling of fatty acid methyl ester alone may improve the initial reaction rate of alcohol and oil, which are substantially insoluble to each other. However, such a process may affect reaction equilibrium and shift the same toward the reverse reaction, in turn decreasing purity of the methyl ester product. Furthermore, although the initial reaction rate is increased owing to the alcohol becoming miscible with oil, the driving force of reaction is reduced. Therefore, the reaction rate is drastically decreased after a certain point of time when the reaction is advanced to some extent, and this becomes a main cause of increasing the size of the transesterification reactor. Accordingly, Sucher leads to a decrease in the efficiency of the whole biodiesel production process due to the above-mentioned complex causes.

In the cited art, as exemplified by Peter, glycerine and crude alkyl ester in the reactants are separated and refined by transesterification and thereafter, methyl ester is

refluxed. *See*, for example, col. 3, lines 57 to 66 of Peter. In contrast, with Applicant's process, the alkyl ester is transesterified in a reactor (14) and is directly recycled prior to going through the glycerine/ester separator (15). *See*, for example, Applicant's Fig. 3, reproduced above. Therefore, Applicant's process recycles alkyl ester and glycerine along with non-reacted tri-, di-, mono-glyceride, rather than refluxing, unlike the processes described in the cited art (e.g. Peter) in which the methyl ester is separated and refined before being refluxed.

Applicant's process has clear advantages over the methods disclosed in the cited art and therefore cannot be said to be obvious in view of the cited art. For example, while Peter initially increases production speed by refluxing only fatty acid methyl esters (to increase the initial reaction rate of alcohol and oil) after separating and refining the reaction products, this shifts the reaction equilibrium in the reverse reaction direction by affecting the reaction balance. Therefore, although initial production speed increases, a reflux method as described by Peter is disadvantageous in that the purity of the produced methyl ester will be lower than that produced by Applicant's process. Furthermore, while the initial reaction rate may be increased with Peter's process, the reaction speed will slow as the reaction progresses, requiring a relatively larger transesterification reactor in compensation. As such, processes such as those described in the cited art lead to a decreased efficiency in the biodiesel production process as compared to Applicant's process.

Conclusion

In view of the foregoing, it is clear that claim 11 is not obvious in view of the cited art and, therefore, is patentable over the cited art. Applicant further respectfully submits that dependent claims 12 and 14-21 are patentable for at least the same reasons as set forth with respect to claim 11. Applicant respectfully requests that the rejection of claims 11, 12 and 14-21 under 35 U.S.C. 103(a) be withdrawn.

All claims being allowable, Applicant respectfully requests an early Notice of Allowance. The undersigned can be reached at the telephone number set out below and welcomes a call from the Examiner at any time to further expedite prosecution.

Respectfully submitted,

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